BANGALORE ELECTRICITY SUPPLY COMPANY LIMITED

"Selection of Service Provider for Sale of Smart Meters to prospective consumers on rate contract basis in retail outlets for arranging power supply to new connections (including temporary installations) along with Supply, Implementation, Commissioning of IT system for a period of 5 years & Maintenance of IT system for a period of 10 years in BESCOM Jurisdiction." vide Tender Enquiry No. BESCOM/2024-25/SE0193

Annexure D
IT System

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1. Overview

The Service Provider(SP) shall Design, Build and Operate the Advance Metering Infrastructure (AMI) system in BESCOM. The SP shall implement the project including end-to-end smart metering, operate for 'Total Meter-months' as defined in this Contract and thereafter transfer the ownership of the entire system including all the hardware, software along with its valid licenses, and any data collected during the Project to the BESCOM at the end of the Contract Period to facilitate seamless operation of Utility businesses. Utility shall make payments to the SP in accordance with the terms and conditions of this Contract.

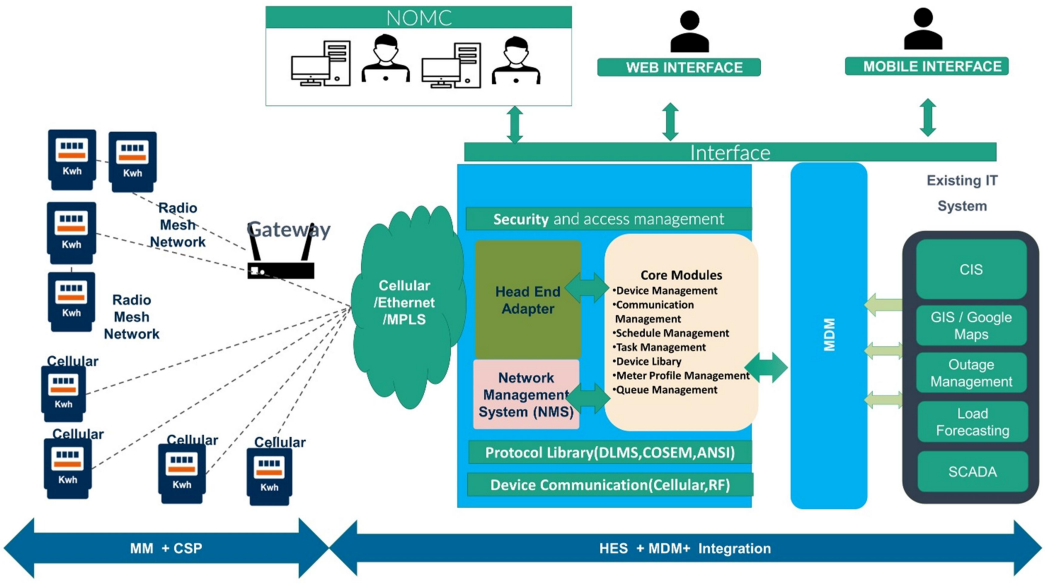
The AMI system should be designed such that all the required hardware, software, and firmware with upgrades satisfy the AMI system requirements and service level agreements as specified in this Contract while considering technical obsolescence over the operating life of the system and suitability for future scale up. SP is free to decide upon the best solution out of all the available options. However, the entire responsibility of fully functional AMI system shall rest with the SP in order to meet the performance levels as given in the Contract. The SP shall ensure that the Solution complies with the Applicable Law, technical specifications and other provisions of the Contract.

BESCOM shall facilitate the following for the successful implementation and operation of the project:

a) Whenever implementation of any component of the Solution requires that the SP obtain permits, approvals, and import and other licenses from local public authorities, if so required by the SP, make its best effort to assist the SP in complying with such requirements in a timely and expeditious manner;
b) approve all such documents required for completion of Pre-Operational Go-Live Phase, within 15 (fifteen) working days from the date of submission of such documents.
c) Provide on SP's request, particulars/ information / or documentation that may be required by the SP within 30 (thirty) days from date of execution of the Contract to enable preparation of the Project Implementation plan by the SP;
d) shall provide all required data to the SP to identify all the consumers connected on the identified sub-stations, feeder lines and transformers of the SP Project area where Smart Meters are to be installed.
e) Implement consumer engagement plan with support of SP. This would include running media campaign to raise awareness and countering myths around smart metering prior to installation, providing SOPs for smart meter installation to SP, etc.
f) Provide all required documents for delivery of material at site.

g) Arrange for necessary shutdowns and work permits.
h) Provide the required integration interface details of the existing billing enterprise and related information required for Operational Go-Live of the AMI system.
i) Give access to SP supervisor or its operation & maintenance staff to work in the Project area during the Contract Period.
j) deleted.
k) Give access to SP to use existing power and water supply, and other necessary equipment, as mutually agreed with the AMISP;
l) Allow SP (and/or its implementation partner, investor(s), authorized agency) unfettered access to network operation cum monitoring centre. Such covered and enclosed space as required by SP shall be provided to it by Utility free of cost during the Contract Period;
m) An engineer-in-charge for the Project who shall render full support to SP for Service delivery during the Term of this Contract and shall coordinate for payment to SP;
n) A nodal officer, Utility Project Manager, to co-ordinate with SP in relation to the Project.
o) Maintain consumer expectations basis the consumer engagement plan;
p) Certify Installation Milestone in accordance with the provisions of this Contract.
q) Upon receiving the written representation from the service provider, all necessary co-operation for seamless integration of the Smart meters, HES and MDM systems, shall be extended from BESCOM officers (GM (ICT&MIS), GM(Revenue) and GM(Customer Relations) for successful implementation of AMI System in BESCOM.

2. IT System- HES, MDM, (WFMS) Mobile Apps & Web APP Specification



General High Level Depiction of the System

a. Head End System (HES)

The main objective of HES is to acquire meter data automatically avoiding any human intervention and monitor parameters acquired from meters.

The SP shall provide HES which is suitable to support the collection and storage of data as per performance level for a defined no. of Smart Meters with facility of future expansion as per the requirement specified in this document.

HES shall be responsible for discovery of all Smart Meters once deployed in the field, the periodic collection of all meter data as well as the processing of all alarms and commands such as connect/disconnect for those meters.

HES would perform all the requisite functions as per the defined functionalities of AMI and it is the responsibility of the SP to supply the requisite software and hardware to achieve the defined functionalities of AMI. HES shall ensure data integrity checks, for example, checksum, time check, pulse, overflow, etc. on all metered data.

HES shall be developed on open platform based on distributed architecture for scalability without degradation of the performance using additional hardware. The scalability shall ensure the ability to handle applicable workloads including the following:

a) [15/30] mins interval meter reads
b) Other events and statuses coming from meters.
c) Data backup facility for storing the interval data fetched from meters and this data shall be accessible as and when required by BESCOM/consumer.

The HES shall be MeitY (Ministry of Electronics and Information Technology) empanelled cloud enabled and support deployment with high availability clustering and automatic load balancing that ensure hardware as well as application failover. Adequate data base and security features for storage of data at HES needs to be ensured.

i. The suggested functions of HES (not exhaustive) may be:

a) On power up after installation, Smart Meter shall register itself automatically into the HES along with its metering profile. The HES shall store meter profile status by meter type, hardware & software versions, device IDs, logged in / logged out details etc.
b) Upon deployment and establishment of communication, it shall be possible for field level end device nodes (NAN/WAN) like Router/Gateway, Access Point, DCU to have self-discovery and registration.
c) Acquisition of meter data on demand & at user selectable periodicity. On demand meter read may be for single meter (unicast) or for a group of meters (multicast).
d) Two-way communication with meter/ DCU
e) Signals for connect & disconnect of switches present in end points such as meters. This facility shall be provided for both single meter (unicast) as well as for a group of meters (multicast).
f) Audit trail and Event & Alarm Logging
g) Ability to redirect messages including configuration commands from the MDM in order to reach the desired meter
h) Maintain time sync with DCU / meter
i) Store raw data for defined duration (minimum 3 days). HES shall hold the data before it is transferred to the MDM
j) Handling of Control signals / event messages on priority
k) Manage time distribution to ensure that nodes / meters always have an accurate RTC using NTP server. The time distribution mechanism shall take into account the network latencies.
l) Setting of Smart Meter configurable parameters
m) Critical and non-critical event reporting functionality
n) Device management functionality to get periodic updates from devices on health check, hardware & firmware version, location mapping etc.
o) The data collection and computation for the purpose of SLA penalties (as mentioned in the following table) should be automated and visualized in Utility Interface.

ii. Configuration

HES shall facilitate configuration of following minimum AMI parameters:

a) Load profile capture period
b) Demand integration period

c) Setting of parameters for TOU billing

d) Prepaid / post-paid configuration

e) Net metering

f) Billing date / month-to-date for prepaid meters

g) Clock setting/time synchronizations

h) Load curtailment limit

i) Event setting for connect/disconnect

j) Number of auto reconnection attempt

k) Time interval between auto reconnection attempts

l) Lock out period for endpoint (meter) relay

m) Remote firmware update: It shall be possible to update the firmware of the meters in both Unicast (one to one) and in Multicast fashion (Group of meters). It shall be also possible to have remote firmware upgrade for an individual and a group of nodes (NAN/WAN, Routers/Gateways/Access Point, DCU.

n) Password setting

o) Push schedule

p) Setting threshold limits for monitored parameters.

The SP may suggest more parameters as per the requirement.

iii. Communication

The following communication functions with network devices shall be supported:

q) HES shall communicate with DCUs/access points using WAN technology.

r) HES shall encrypt data for secure communication.

s) HES shall be able to accept data according to IS 15959 part-2 /part 3 and latest amendments.

t) HES shall automatically retry for missed data; the number of retry attempts shall be configurable.

u) To receive confirmation on successful execution of a command

v) HES shall ensure data integrity checks, for example, checksum, time check, pulse, overflow, etc. on all metered data.

iv. Monitoring and Reporting Capability

HES shall have critical and non-critical reporting functionality. The critical

& non-critical information generated from this reporting functionality shall be made available to MDM at user configurable periodicity.

v. Critical Reporting

HES shall have alarms and keep record of following events:

a) Event log for node's (meter) events such as tamper/power failures etc.

b) Data not received from nodes/end points

c) Relay does not operate for connect / disconnect

d) Communication link failure with nodes/end points

e) Network Failure

f) Power Failure

Note: Critical reports in the event of Tamper shall be made available for Meter Testing Division of BESCOM for further analysis.

vi. Non-Critical Reporting

HES shall report and keep record of following communication failure events:

g) Retry attempts

h) Missed periodic reading

i) Failure to connect

HES shall support reporting of communication failure history of nodes/routers/access points etc. and give an exception report for nodes/routers/access points not communicating for last 0 – 24 hours (the reporting period shall be on user configurable period). HES shall have feature to send email/SMS notification of configured alarms & events to its users.

b. Meter Data Management system (MDM)

The Meter Data Management system (MDM) shall support storage, archiving, retrieval & analysis of meter data and various other MIS along with validation & verification algorithms. The MDM shall be a scalable. It shall act as a central data repository with interactive dashboard. MDM shall have capability to import raw or validated data in defined formats and export the processed and validated data to various other systems sources and services in the agreed format. It shall provide validated data for upstream systems such as billing, analytics, reporting, etc.

MDM should support the future requirement of utility by way integration with other smart grid functionalities as and when implemented by Utility.

The key use cases to be enabled by SP are provided below. Please note that these are illustrative list of use cases only and are not an exhaustive list. Further please note that all IS Standards shall be applicable.

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
1.	**Collection of Daily Meter Profile**			
1.1	At scheduled frequency HES should pull the Daily Meter Data from Smart Meter over communication Channel	HES	Meter	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non- critical Event Code / Date
1.2	Meter should send the data to HES. Provision for retrial should be there if Meter data is not collected within time. Consumption details including non-critical events will be in 15 min/30 min block data, and data could be incremental to what was sent by meter in preceding instance	Meter	HES	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non- critical Event Code / Date
1.3	HES should send the data to MDM	HES	MDM	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF
1.4	MDM should send the required parameter to Prepaid system for daily charge calculation at least once on daily basis	MDM	Prepaid Engine	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non- critical Event Code / Date
2.	**Monthly Billing profile collection**			
2.1	Command from Billing system triggered and send to MDM / HES for collection of Monthly billing Data	Billing System	MDM / HES	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non- critical Event Code / Date

Sr.	Use Case Activity	Source	Destinatio	Info Exchanged

	Description		n	
2.2	At scheduled frequency HES should pull the monthly meter data from Smart Meter over the communication channel	HES	Meter	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non-critical Event Code / Date
2.3	Meter should send the data to HES. Provision for retrial should be there if Meter data is not collected within time.	Meter	HES	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non-critical Event Code / Date
2.4	HES should decrypt and validate the data collected and send to MDM	HES	MDM	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non- critical Event Code / Date
2.5	MDM should send the required parameter to Billing system for Monthly Bill calculation	MDM	Billing Engine	Meter Number, reading date & time, kW, kVA, kWh, kVAh, PF, Non- critical Event Code / Date
3.	**Remote Meter disconnection**			
3.1	Meter disconnect operation command after wallet balance calculation	Prepaid Engine / Billing system	MDM	Meter Number, group ofmeters, instruction to close switch
3.2	Disconnection alert sent toconsumer	MDM	Billing System	Meter Number, group ofmeters, instruction to close switch
3.3	Meter disconnection operatorcommand	MDM	HES	Meter number, action (disconnect)
3.4	Consumer meter disconnectio n	HES	Meter	Meter Number, switch status
3.5	Disconnection Status Update	Meter	HES	Meter Number, switch status
3.6	Disconnection Status Update	HES	MDM	Meter Number, switch status

4.	**Remote Meter Reconnection**			
4.1	Meter reconnect operation command after wallet recharge Billing	Billing system / Prepaid Engine	MDM	Meter Number, group of meters, instruction to close switch
4.2	Meter reconnect operation command	MDM	HES	Meter Number, group of meters, instruction to close switch
4.3	Consumer meter reconnection	HES	Meter	Meter number, action (reconnect)
4.4	Reconnection Status Update	Meter	HES	Meter number, action (reconnect)
4.5	Reconnection Status Update	HES	MDM	Meter number, action (reconnect)
5.	**Utility detects tampering at consumer site**			
Sr.	**Use Case Activity Description**	**Source**	**Destination**	**Info Exchanged**
5.1	High priority events captured by Meter sent to HES as and when occurred	Meter	HES	Meter Number, event date & time, event Code /description
5.2	High priority events reach MDM for further action.	HES	MDM	Meter Number, event date & time, event Code /description
5.3	Share with WFM to Notify utility personnel for site inspection	MDM	WFM	Consumer number, Meter Number, Tamper code, address
5.4	On analysis and detection of valid tamper event or malfunction, the tamper event must be sent / pushed by the meter to the HES /MDM	Meter	HES/ MDM	Consumer number, meter number, action to be triggered (disconnect), action date & time
5.5	HES sends disconnect command to meter	HES	Meter	Meter Number, action (disconnect)
5.6	Tamper event shared with CIS/CRM. Billing determinants	MDM	CIS / CRM	Meter Number, event date & time, event Code

	are updated for tamper invoicing			/description
5.7	Meter re-connection order once tamper issue is resolved	MDM	HES	Meter number, action (re-connect)
5.8	HES sends re-connect command to meter	HES	Meter	Meter Number, action (re-connect)
6.	**Missed interval readings**			
6.1	On identifying missed interval, HES will re-acquire data for the missing period from meter	HES	Meter	Meter Number, from date & time, to date & time (for which data is missing)
6.2	On receiving data request command, meter will send data to HES	Meter	HES	Meter Number, reading date & time, kW, kVA, kWh, kVAh
6.3	Missed Interval and Reads Data acquired by MDM	HES	MDM	Meter Number, readings with date & time
7.	**Consumer connection outage/restoration event**			
7.1	Outage/restore event recorded by meter is sent to HES as and when event occurs	Meter	HES	Meter Number, Outage / restoration Date / Time, Power On or Off count
7.2	Outage / Restoration Notification	HES	MDM	Meter Number, Outage / restoration Date / Time, Power On or Off count
7.3	Sharing Outage / Restoration Notification	MDM	OMS/CIS -CRM	Meter Number, Outage / restoration Date / Time, Power On or Off count
7.4	Meter read request from OMS to identify service outage / restoration	OMS	MDM → HES	Meter Number,
7.5	Meter responds to event poll from HES	Meter	HES	Meter number, Status (live/dead)

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged

8.	**Remote firmware upgrades/ meter configuration changes**			
8.1	Remote firmware upgrade	HES	Meter	Firmware
8.2	Configuration Commands: Change tariff parameters, Synchronize clock, Registers reset (status, max, tampering)	HES	Meter	Meter number, tariff parameters, registers status, event type and priority
8.3	Status update of Firmware / Configuration	Meter	HES	
9.	**Load monitoring at demand side**			
9.1	When there is a load violation event recorded in the meter, the information is sent to the CC	Meter	HES → MDM	Meter Number, max demand, date & time of load violation
10.	**Time synchronization**			
10.1	Synchronizing RTCs of meters / DCUs/ACP	HES	DCU/Meter	Time Setting
11.	**Metering network changes**			
11.1	Change / new installation in Meter / DCU Network Hierarchy	Meter / DCU	HES	Network identification info including DCUs
11.2	Change / new installation in Meter / DCU Network Hierarchy	HES	MDM	Network identification info including DCU
12.	**New consumer connection**			
12.1	Receive verified pre & post-paid new consumer requests	CIS-CRM/ Billing	MDM	Consumer name, address. Connection request etc.
12.2	Generate meter installation order	MDM	/WFM	Consumer ID & details
12.3	Receive meter installation report	WFM	MDM	Meter number, DT no, Feeder & reading
12.4	Requesting instant, interval & events data from meters	MDM	HES → Meter	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)

12.5	Acquire instant, interval / events data from meter by HES which then reaches MDM system.	HES	MDM	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
12.6	Once new meter remote read verification is over, confirm new connection with other applications	MDM	Billing / CIS-CRM	Consumer ID, Consumer address, Meter Number, initial reading etc.
13.	**Migrate post-paid consumer to prepaid mode**			
13.1	Receive migration request	CIS-CRM/ Billing	MDM	Migration request for post-paid consumer with profile
13.2	Setup prepaid consumer profile in prepaid engine. If no change in meter is required, skip next two steps	MDM	Prepaid Engine	Prepaid consumer profile
13.3	Generate prepaid meter installation order if required	MDM	WFM	Consumer ID & details
13.4	Receive meter installation report	WFM	MDM	Meter number, DT no, Feeder & reading
13.5	Enable prepaid mode in meter	Prepaid engine	HES → Meter	Engineering token
13.6	Receive activation confirmation	HES	MDM	Activation status
13.7	Request instant, interval &events data from meter	MDM	HES → Meter	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
13.8	Acquire instant, interval / events data from meter by HES which then reaches MDM system.	HES	MDM	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
13.9	Once meter remote read verification is over, share migration request completion detail with other	MDM	Billing / CIS-CRM	Prepaid consumer profile

	modules			
14.	**Migrate prepaid consumer to post-paid mode**			
14.1	Receive migration request	CIS-CRM	MDM	Migration request for prepaid consumer with profile
14.2	Request meter data	MDM	HES → Meter	Meter Number, Consumer ID
14.3	Acquire instant, interval / events data from meter by HES which then reaches MDM system.	HES	MDM	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.) with balance credit
14.4	Send meter disconnect command	MDM	HES → Meter	
14.5	Receive connection status	HES	MDM	Disconnect status
14.6	Enable post-paid mode in meter	MDM	HES → Meter	Engineering token
14.7	Receive activation of post-paid mode	HES	MDM	Activation Status
14.8	Request instant, interval & events data from meter	MDM	HES → Meter	Meter Number, Consumer ID
14.9	Acquire instant, interval / events data from meter by HES which then reaches MDM system.	HES	MDM	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
14.10	Once meter remote read verification is over, share migration request completion detail with other modules	MDM	Billing / CIS-CRM	Post-paid consumer profile and meter data along with credit balance
15.	**Consumer Registration in Consumer Portal/ App**			
15.1	Consumer clicks on new user on consumer portal/ App, provides RMN or email ID and submits data	Portal/ App	CIS/CRM	Request for registration with RMN/email ID

15.2	Utility receives request for registration and sends OTP after verification	CIS/CRM	Email/Message Gateway	OTP
15.3	Consumer submits OTP	Portal/ App	CIS/CRM	
15.4	Consumer receives registration detail	CIS/CRM	Email Gateway	Login ID and default password
15.5	Consumer submits first login request	Portal/ App	CIS/CRM	
15.6	System seeks password change	CIS/CRM	Portal/ App	
15.7	Consumer changes default password	Portal/ App	CIS/CRM	
16.	**Consumer Access to Consumption, Billing & Profile Data**			
16.1	Consumer logs in to Portal/App	Portal/ App	MDM	
16.2	Consumer Profile for Portal/App	CIS-CRM	MDM →Portal/ App	Name, Account, Address, Service Points, K Number
16.3	Consumption Data	MDM	Portal/ App →UI	Consumption profile
16.4	Billing (post-paid) / Credit Balance (prepaid)	Billing → MDM	Portal/ App	Post-paid Billing history/Current Bill, Prepaid Recharge history
17.	**Prepaid Consumer Recharge**			
17.1	Consumer logs into Portal / Mobile App	Mob App / Portal	UI	Login
17.2	Consumer fills-in required detail in UI and requests recharge	UI→ Prepaid App	Payment Gateway	Consumer ID, Recharge amount
17.3	Consumer selects payment method	Payment Gateway	Net banking /Credit Card / Wallet etc.	
17.4	Consumer receives payment acknowledgement	Payment Gateway	Prepaid App→Portal→ UI	

17.5	Calculate credit balance for prepaid consumer & update prepaid meter	Prepaid App	HES→Meter	Consumer credit balance (virtual token)
17.6	Notify credit balance to consumer	Prepaid App	Email/SMS Gateway	Credit Balance
18.	**Post-Paid Consumer Bill Payment**			
18.1	Consumer logs into Portal / Mobile App	Mob App / Portal	UI	Login
18.2	Consumer is presented with Billing history and current outstanding Bill	Billing → MDM	Portal/ App→UI	Outstanding Bill
18.3	Consumer requests bill payment. Option to download bill	UI→Billing	Payment Gateway	
18.4	Consumer selects payment method	Payment Gateway	Net banking /Credit Card / Wallet etc.	
18.5	Consumer receives payment acknowledgement	Payment Gateway	Billing→ Portal/ App→UI	
18.6	Payment acknowledgement through email/SMS	Billing	Email/SMS Gateway	Payment acknowledgement
19.	**Consumer Service Request**			
19.1	Consumer logs in to Portal/ App	Portal/ App	CIS/CRM	
19.2	Consumer requests for service	UI	CIS/CRM	Service request
19.3	System assigns SRN & sends acknowledgement	CIS/CRM	Portal/ App→UI, Email/SMS Gateway	
19.4	System resolves request & updates consumer records	CIS/CRM	Portal/ App→UI, CIS/CRM	

19.5	System closes SRN	CIS/CRM	Email/SMS Gateway	
20.	**Consumer Complaints**			
20.1	Consumer logs into Portal/App	Portal/ App	CIS/CRM	
20.2	Consumer registers complaint	UI	CIS/CRM	Specific complaint
20.3	System assigns CRN & sends acknowledgement	CIS/CRM	Portal/ App→UI, Email/SMS Gateway	
20.4	System assigns resolution based on nature of complaint	CIS/CRM	CIS / OMS / WFM	
20.5	Target system reports completion of complaint	OMS / WFM	CIS/CRM	
20.6	System updates records and closes CRN	CIS/CRM	CIS, Email/SMS Gateway	

Sr.	Use Case Activity Description	Source	Destination	Info Exchanged
21.	**Demand read of meters from consumer premises**			
21.1	Requesting instantaneous, interval, load profile & events data from meters	MDM	HES→Meter	Meter Number, Reading date & time, reading params (kWh, kVAh, kW etc.)
21.2	Acquire instant, interval, load profile & events data from meters by HES which then reaches MDM system.	Meter→ HES	MDM	Meter Number, Reading date & time, reading params (kWh, kVAh, kWetc.)
22.	**Staff User Access to Utility Portal**			
22.1	User logs in to Portal	Portal	MDM	Login with appropriate credentials
22.2	User selects available functions	MDM	Portal → UI	
22.3	User logs out	Portal →UI	MDM	

Note: The SP shall provide access to Consumers to remotely operate (disconnect) his meter when not in use. Also, the Consumer shall also have the facility to disconnect his meter through BESCOM. (By sending command from HES to the meter)

The SP shall specify and deliver an initial system that supports the collection and storage of data for meeting the performance level for [X no of consumers/ Smart Meters] with facility of future expansion.

The MDM shall have the ability to selectively choose which data to be maintained and which to be purged or archived [as per requirement of Utility (user selectable)]

i. Asset Management

a) The MDM shall maintain information and relationships between the current installed meter location (apartment, shop, industry/ address etc.), Consumer information (Name etc.), Consumer account no, Meter ID, Type of Meter (type of consumer, 1 phase/ 3phase, with or without relay, etc.), Meter configuration (Demand integration period, Load profile capture period etc.), GIS supplied information (longitude, latitude, connection with feeder/ transformer/ pole etc.) etc.

b) The software should support tracking the status of meters and communication equipment from the date when they are installed in the field. The history of in-service asset location is maintained throughout the device life with start and end dates associated with each in-service location reference.

c) Ability to report and log any damage / deterioration in the meter attributable to consumer /utility.

ii. AMI Installation Support

a) The MDM shall also support device lifecycle management from device registration, installation, provisioning, operations and maintenance to decommissioning etc. The MDM shall generate exceptions for meter or modules not delivering the correct meter data after installation.

b) The MDM shall provide a reconciliation report that identifies the meters that have been installed but not communicating for a designated (configurable) period. MDM shall generate reports on the number of meters installed in comparison to the number of meters successfully communicating.

iii. Meter Data

a) The MDM shall accept input, process, store, and analyse Meter data from HES and meter data collected through handheld meter reading instruments and manual meter reads. In case of manual reads, provision should be there to insert associated notes such as assessed energy, etc. It would responsibility of AMISP for manual meter reading in case of any communication failure, etc. with seven (7) days of such failure.

b) The MDM should accept input, process, store, and analyse non-billing meter data such voltage and power quality data (such as under/over voltage, out of band frequency, etc.) as they are available from HES. The MDM should also support schedule and on-demand meter reads and pinging of meter energized states by authorized users and by other utility systems.

c) The MDM shall provide storage and retrieval of all collected Meter Data, events and alarm. It shall have capacity of storing 2 years data (as required by the utility based on regulatory provisions) via archiving

d) The archiving of data should be done and all data older than 90 days should be archived. SP's solution should describe the process of archiving and restoration from the archive.

e) Correctly track & resolve energy usage across meter changes with no loss of individual meter data.

f) Provide complete history and audit trail for all data collected from meters including commands sent to meters and other devices for 30 days (configurable period).

g) Execute on-demand read processes.

h) Handle special metering configurations such as net metering/pre-paid metering/multiple meters at same premises.

i) The MDM shall have the ability to manage at a minimum 15-minute interval data.

j) The SP shall ensure data integrity checks on all metered data received from data collection systems.

iv. Data Validation, Estimation, and Editing (VEE)

a) The validation and estimation of metered data shall be based on standard estimation methods (such as max/avg. of past three days, max/avg. of past X number of similar weekdays, max/avg. of similar blocks of past X numbers of similar weekdays, etc.). The MDM should also support and maintain following data-

   i. Registered Read Data including register reads, daily billing cycle, as well as derived billing determinants such as TOU

ii. Interval Data channels with variable intervals and variable units of measure

iii. Calculated Data that is derived or computed such as billing determinants and aggregated loads.

iv. Event data storage of all collected event and alarm data from meters, network equipment, and MDM itself

b) MDM shall flag, alarm and trigger an estimating process including but not limited to when the following anomalies occur in the cumulative ("CUM") register reads

i. CUM decrements within a billing cycle (except net-metering)

ii. CUM reads increments more than configurable threshold

iii. Future or old read dates

iv. Number of digits exceeds number of meter dials

c) MDM shall detect, flag, alarm and trigger an estimating process including but not limited to when the following anomalies occur in Time of Use (TOU) register reads

i. Register decrements (except net-metering)

ii. Resets (to zero) (except net-metering)

iii. CUM reads increments more than configurable threshold

iv. Future or old read dates

v. Erratic compared to CUM read (sum of TOU reads minus CUM read).

d) MDM shall detect, flag, alarm and trigger an estimating process including but not limited to when the following anomalies occur in Demand register reads

i. Do not reset on cycle

ii. Do not reset coincident with consumer move-out or move-in

iii. Reset off cycle inappropriately

iv. Too high

e) All data shall be transferred to billing system after meter data validation and estimation including transformer / feeder station wise energy audit

f) MDM shall estimate usage for non-metered service points such as streetlights, farm lights, traffic signals, etc.

g) The MDM shall maintain both the original received raw data in a non-manipulated state, in addition to VEE data

h) Notwithstanding the latency of data collection via the AMI system, once the MDM receives meter read data, the VEE process occurs in real-time and the post-VEE data is then immediately available to user or external systems.

i) The MDM shall be able to automatically flag data changes from manual edits, VEE (Validating, Editing and Estimating) rules and data source corrections and electronically generate audit trail with timestamps and user-ids.

v. Billing Determinants Calculations

The MDM-

a) Shall allow configuring multiple TOU options (e.g., the number and duration of TOU rate periods) by consumer type, tariffs and day type (weekend, weekdays, and holidays) and by season.

b) Shall support the processing of interval data into billing determinants to include the following at a minimum:

i. Total Consumption
ii. Consumption in different time blocks for ToU billing
iii. Maximum Demand (in kW and kVA)
iv. Number of tamper counts
v. Average power factor
vi. Net-Metering data

c) Shall process interval data and frame it into the appropriate TOU periods for consumption and demand; for example, roll up 15/30-minute data intervals into hourly data.

d) Shall have the ability to properly account for special metering situations such as check metering, sub metering, prepaid metering and net metering when calculating billing determinants and sending them to billing and other systems.

e) Shall have the ability to properly account for special situations including, but not limited to, curtailment requests, demand response scenarios (based on use cases provided in Annexure H) when calculating billing determinants and sending them to billing software

f) Shall have the ability to facilitate implementation of automatic compensation payments by Utility to consumers for sustained outages when requested. Compensation calculations would require cross

checking with billing and consumer balance information to ensure that disconnection is not construed as a no supply event.

vi. Prepaid functionality

The MDM with the help of the corresponding HES, should be able to switch the Smart Meter between prepaid and post-paid modes by a simple change in configuration of the Smart Meter firmware remotely. The following prepaid functionality shall apply

a) MDM shall use consumer attributes from Consumer Care System (CCS) and/or Utility Billing system to,

   i. Enroll and setup new prepaid/ post-paid consumers

   ii. migrate existing post-paid consumers to prepaid mode and vice-versa.

b) An appropriate pre-payment application engine shall support the pre-payment metering capability through the delivered system.

c) The prepayment system shall ensure that payment and connection parameters are stored centrally, and the details are updated to CIS-CRM/MDM through consumer portal/ app as per Clause 2.3 of this Section. Information required by consumer's Mobile App and web portal are shared in near real time.

d) Prepaid consumers shall be provided facility to recharge their account by logging on to the consumer portal/app as per Clause 2.5 of this Section.

   i. The user interface shall be integrated with the present online payment gateway of the utility. Additional payment gateways shall be implemented if required

   ii. The payment gateways shall facilitate payments through on-line banking, credit cards and payment wallets

e) A prepaid mobile application functionality shall be provided as a recharge option for android OS and iOS. The consumer portal/ app, shall enable consumers to recharge as well as view recharge history, existing balance, daily usage etc.

f) In addition to billing determinants, the MDM shall share, consumer recharge and credit updates with the utility Billing system. Any re-conciliation shall be carried out in the Billing System and the same shall be shared with the MDM for use by the prepayment application.

g) The system shall periodically monitor the energy consumption of prepaid consumer and decrease the available credit based on consumption. For this purpose, the MDM shall fetch billing data (kWh/kVAh consumption

and MD) at configured intervals4 from the prepaid meter. The raw billing data shall be subjected to standard VEE rules before being used to update recharge balance with the help of applicable tariff slabs. The credit balance is updated into meter at re-charge time.

h) The prepayment application shall use determinants such as minimum fixed charges, TOU tariffs, slab rates, duties & surcharge while calculating consumer credit/balance. Fixed charge shall be deducted on daily basis irrespective of the consumption, even after disconnection of supply and adjusted in the next transaction.

i) The prepayment application should be able to automatically apply different TOU tariffs for future date lines, while calculating consumer credits.

j) The system should send connect/disconnect command based on available credit as per notified rules & regulations.

k) The system should send low-credit notifications to the consumer when their balance approaches a pre-configured threshold. Alerts shall initiate on every recharge, low credit and load connection/disconnection. The alerts shall be posted on the consumer web Portal/ App in real time and sent through SMS and email. Consumer should also be alerted through other mechanisms such as one-time alarm / beep from the meter, LED blinking, message, etc.

l) It shall be possible to configure an "emergency" credit limit in INR as well as day terms. This emergency credit shall be used as reserved amount that is consumed when consumer credit is exhausted. The credit amount shall be adjusted in next recharge transaction.

m) It shall be possible to configure certain prepaid consumers where auto-disconnections shall not happen due to negative credit. The conditions/protocols for auto-disconnections are detailed in Annexure I.

n) The pre-payment function as part of MDM shall also have a facility to configure arrear recovery mechanism to recover arrears from a consumer. Some of the indicative mechanism to recover the same can be recovery of [X]% from every recharge amount while the rest goes as charging amount till all the arrears are recovered. Alternately the arrears may be settled in next [X] instalments as decided by utility such that not more than 50% of any instalment shall be adjusted towards arrear.

vii. Net Metering

MDM shall flag, alarm and trigger an estimating process including but not limited to when the following events occur:

a) CUM decrements of forward energy within a billing cycle

b) Register decrements for Time of Use (ToU) of forward energy

c) Power generated(exported) by any net-metering consumer more than the installed capacity ofsolar PV rooftop system

d) Energy exported in any given day by any net-metering consumer more than the programmable threshold value

Like billing for post-paid meters, the billing for net-meters shall take place in the utility Billing server.

viii. Exception Management

a) Ability to capture and log data exceptions, problems and failures and to generate management reports, provide trend analysis, automate generation of service requests and track corrective actions.
b) Ability to group, prioritize, filter and send system generated alarms and events to predetermined email addresses, cellular text messages to phone numbers/SMS/consumer care etc. Alternatively, these alarms/alerts may be routed to utility's WFMS.
c) Exception Generation - MDM shall generate exceptions based on configurable business rules including but not limited to the following:

i. Meter tamper alerts
ii. Communication module health alerts for meter/DCU
iii. If the consumption is less/more than pre-defined average consumption
iv. Negative Consumption (not for net-metering)
v. Power outage indications received from the Smart Meter

ix. Service Orders

a) The MDM shall generate service orders based on configurable rules for various events and alarms such as stop meter, tampers, problem in communication networks, etc.

b) MDM shall send service orders via SMS, email, etc. with the email addresses / phone numbers being configurable. MDM shall receive feedback on action taken on the service order and track the status of service orders until resolution.

c) Service order tickets could be generated by MDM but processed and closed under jurisdiction of the HES-NMS combine. If the utility already has a separate Workforce Management System (WFM), then the service order tickets can be routed from the MDM and the NMS to the WFM for completion of the tasks and reporting.

x. Revenue Protection Support

a) Ability to analyse meter tampering flags, power outages, usage trends and usage profiles to identify potential energy diversion situations, and produce daily reports, monthly reports and service order requests for investigation.

b) The business rules for revenue protection alerts shall be configurable via a user-friendly interface.

c) The MDM shall filter out revenue protection alerts that may be caused by field activities if the field activity information is provided to the MDM.

d) The MDM shall support the analytics/investigation (i.e., view current and historical usage patterns) to validate suspected revenue protection issues.

c. Utility Interface and Consumer Portal/ App

i. Utility User Interface

User interface for utility shall have ability for at least the following functionality:

a) Compare total energy costs on one rate schedule vs. one or many alternative rates.

b) Enable the user to see how different options within a rate affect costs.

c) Enable the user to see how adjusting load or consumption levels or shifting them to different time periods influences costs.

d) Display meter data at a user defined configurable cycle that allows authorized users to view energy usage patterns and the data behind them for selected consumers.

e) Allow authorized users to view metered data, initiate and view reports, modify configurations, and initiate and update service requests.

f) Display the energy usage profile for a single meter or group of meters. The load profile shall illustrate energy consumption and peak demand in user defined intervals for a user-specified time period.

g) Display the energy usage profile for a single meter or group of meters according to Time of Use (ToU) tariff.

h) The UI shall support a configurable utility dashboard for Operations and Utility Management

i) Access to a minimum of three (3) years of historical energy usage and meter reads through the UI.

j) Clearly and visually distinguish between metered, estimated, allocated and substituted data.

k) User management with roles and access rights

l) GUI to provide role-based access based on user identity and user role. Shall have following types of users:

i. Administrator

ii. Operator

iii. Field staff

iv. Viewer/Guest

m) Configure the look, feel, and functionality of the MDM in accordance with business needs, business processes, and business conventions. (E.g., GUI, content, look and feel of screens, validation rules, exception handling, etc.).

n) Ability to set up alarm and event notifications that can be directed to a combination of configurable email addresses, cellular text messages.

o) UI shall enable viewing of the credit amount updated in MDM for prepaid consumers.

p) Option to send marketing messages and notification to select consumers or selected category of consumers

q) Facility to enable or disable existing functionalities/sections of App/Portal for consumers use.

r) Consumer views to be available to Utility consumer Service Executive also except payment card/bank information.

s) Authorised representative to be enabled for consumer engagement analytics. The analytics to be configurable/ generated with minimal database skill and nil programming requirements.

t) Representative to be able to generate various reports at different intervals the various reports as per Clause 6 of this Section. It shall be also possible to export the report data in multiple formats such as XLS, CSV format, etc.

u) Provide consumer interactions history to enable efficient consumer complaints and queries resolution with consumer information in single screen.

d. Consumer Portal/ App

Consumer portal and mobile application shall cover all consumer categories and category specific features as applicable prior to operational Go-Live. These apps shall have provision to enable features required to facilitate consumer participation in Demand Response programs which the utility may choose to roll out in future. The consumer web portal and the mobile application (for smartphone and tablet devices using latest and commonly available browsers and operating systems and platforms) shall provide consumers, ready access to

features extended by MDM. The Solution shall integrate via a user-friendly graphical interface. It shall facilitate self service capabilities such as usage management, billing, service requests, participation in energy efficiency programs etc. It shall be noted that the Consumer Portal / App acts as the bridge between the consumers touch point and the existing utility Customer Care and Billing Systems. It does not replace these legacy systems in place. Following features shall be supported by Portal / Mobile app:

a) The mobile app and web portal shall support all device form factors such as mobile, tablet, desktop etc. by recognizing the device details automatically.

b) It shall be OS agnostic to operating system and devices (iOS, Android, etc.)

c) It shall work on all standard browsers such as Internet Explorer (IE), Chrome, Safari, Firefoxetc.

d) The application should be modular and scalable a COTS product.

e) The application should be native for better user experience.

f) It shall support multiple languages viz Hindi, English and local language(s). Also, notifications should be sent to consumers in local languages.

g) The user experience of the citizen on the Portal and App shall be similar in terms of look and feel, navigation, menu and access to preferences and other data.

h) Menu should have navigation options, not limited to, Home, Settings, Recharge, notification preferences, usage rates, change password, terms and conditions, privacy policy, sign out.

i) It shall have search functionality across all the pages.

Software patches, updates, and version upgrades, when they become available for general release, should be part of ongoing support and maintenance services.

i. Functional Requirements of Consumer Portal/ App

Web portal and Mobile app for consumers should have minimum following functionalities:

a) The consumer portal/app shall have a landing Home page. This page shall provide a brief description about the Utility, any promotional features or advertisement for special programs can be placed in this page. Login Component is provided, and registered users may login using their username and password. New Users can also register by clicking on the First Time Users Register link. The Forgot Password link helps the user to retrieve their password. New users can register by providing their personal information and setting up of security answers. Forgot passwords can be retrieved or reset using OTP through registered mobile number or through email address. The registered users can change their password and account information as well as registered mobile number through OTP feature.

b) The consumer portal/app shall provide consumers with access to consumer ID, meter ID, meter type and name plate details, besides other account information such as account name, address, balance, due, status etc. Any status message pertaining to the account/s viz. alerts/actions shall be displayed here. It shall also provide current and historical consumption in graphical formats for at least 12 months. A more detailed analysis can be provided in a tabular format listing meter reading date, reading, consumption, charges, selected period etc. Consumers shall be able to view interval data, outage flags, voltage, power quality indications, existing tariffs and incentives for selected period. Information about different consumer engagement programs shall also be displayed here.

c) The portal/app shall have the ability to provide option for registering in online/paper billing to the consumer. There shall be a bill summary page that shall display bill information in summary and also option for detailed view and download in pdf format if required by consumer. The use shall be able to pay bill for single and multiple accounts.

d) The portal/app shall be integrated with existing helpdesk of the utility and have the ability to provide option for recording service requests/complaints lodged by the consumer as new connection, disconnection, load change, category change, meter shifting etc. The user can view the service request status. The user can register complaints viz. power failure, faulty meter, streetlight outage etc. There shall be option to track status of service requests.

e) Mobile App and Web Portal shall facilitate Chat-bot functionality of the utility's Help Desk. The portal/ App shall support configuration of notification types via email/ SMS/ message/ automated call (through utility IVRS), of configured alarms & events.

f) The information on consumer identification no., meter ID, name plate details, make, type i.e., 1 Phase or 3 Phase, etc. (as per requirement of Utility) shall be updated in HES, MDM, and the consumer portal/app.

g) The portal/app shall provide option to the consumer to view/download online bill. There shall be a bill summary page that shall display bill information in summary and option for detailed view and download in pdf format. The user shall be able to pay bill for single and multiple accounts.

h) The portal/app shall also provide platform for implementation of peak load management functionality by providing existing tariff & incentives rates, participation options etc. The portal/app shall also provide consumers with interval data, flags, voltage, power quality indications etc. Show outage information in map view.

i) There should be different UI and landing pages for different type of consumers as per the need of utility.

j) User interface to consumer Portal/ App to access consumer's data from MDM for all authorized consumers shall have ability for at least the following functionality:

i. View metered data, monthly average usage, current monthly consumption, maximum demand and other reports
ii. View data according to Time of Use (ToU), day, week, month, year and season etc.
iii. Update profile information such as mobile number/email etc.
iv. Guest user account/multi-user account access facility for consumer convenience
v. Initiate request for connection/disconnection
vi. Initiate request to switch between pre-paid and post-paid mode
vii. Initiate service requests for maximum demand updating, meter checking etc.
viii. Initiate complaints such as Meter not working, supply off etc.
ix. In case on net-metering consumers, user can view data for both import & export data
x. Can view recharge history, present balance, next possible recharge date and amount etc.
xi. Historical energy consumption and energy charges during the desired time period
xii. Facility to recharge their account through the payment gateway facilitated by the utility.

Sd/-

General Manager Ele.,
DAS, SG & TIC
BESCOM.

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